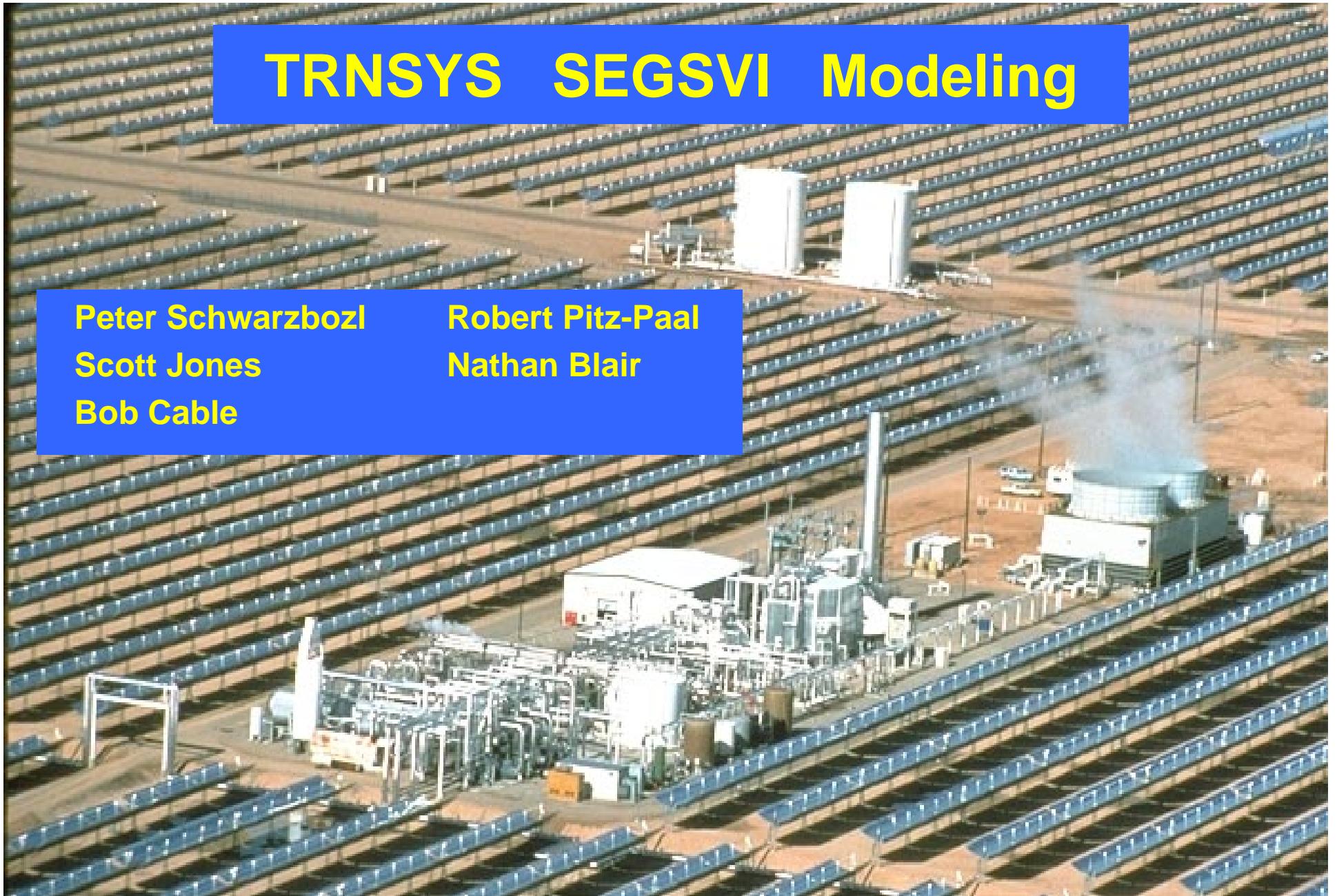


TRNSYS SEGSVI Modeling

Peter Schwarzbozl
Scott Jones
Bob Cable

Robert Pitz-Paal
Nathan Blair



Other Trough Models

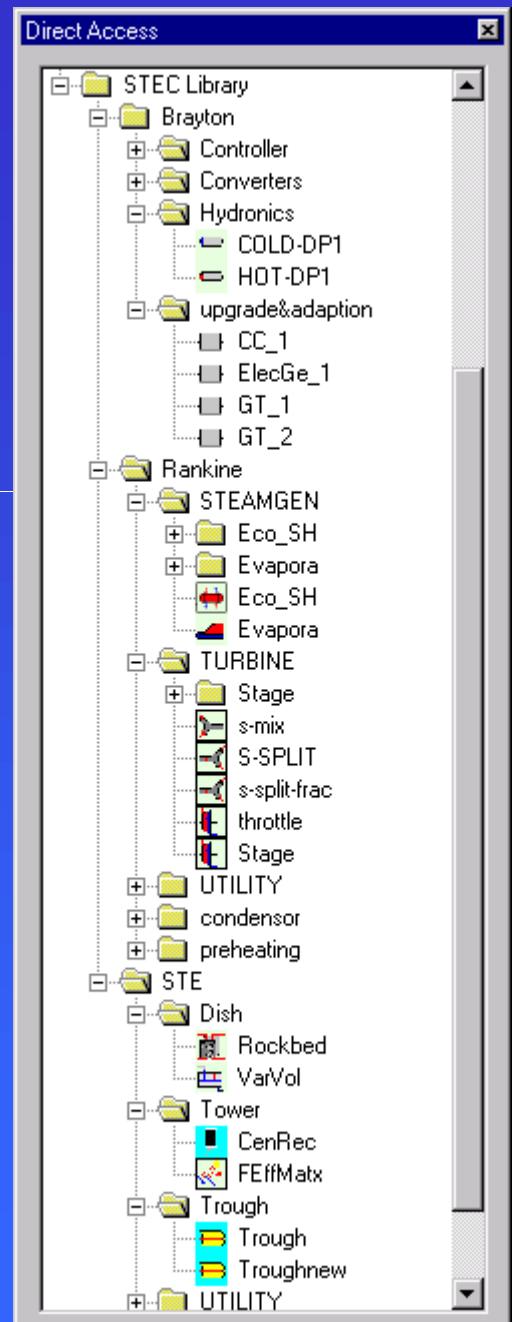
- Luz system performance model
- KJC performance model
- Flagsol
- Easy
- Many more
- Complexity varies
 - Simple model can give reasonable annual predictions
 - More complexity required for shorter time scales
 - Accurate modeling of temporal effects lacking
- Many Tower and Dish models also

TRNSYS

- **Modeling objectives**
 - Flexibility in system models
 - Model typical daily transients
 - Detailed subsystem simulations
 - Annual performance simulations
 - Tool to evaluate performance and operation issues with thermocline storage systems that have been proposed
 - Foster international collaboration, common basis for comparison
- **Simulation environment**
 - University of Wisconsin
 - Historically used for buildings, low-temperature solar
- **Modular & Flexible**
 - Create new components
 - Easily Create new systems by linking components (e.g. Hybrid)
 - Both detailed and simplistic models possible
- **Open environment**
- **moderate cost**
- **Windows® graphical interface**
- **Version 15 a big improvement**

STEC Library

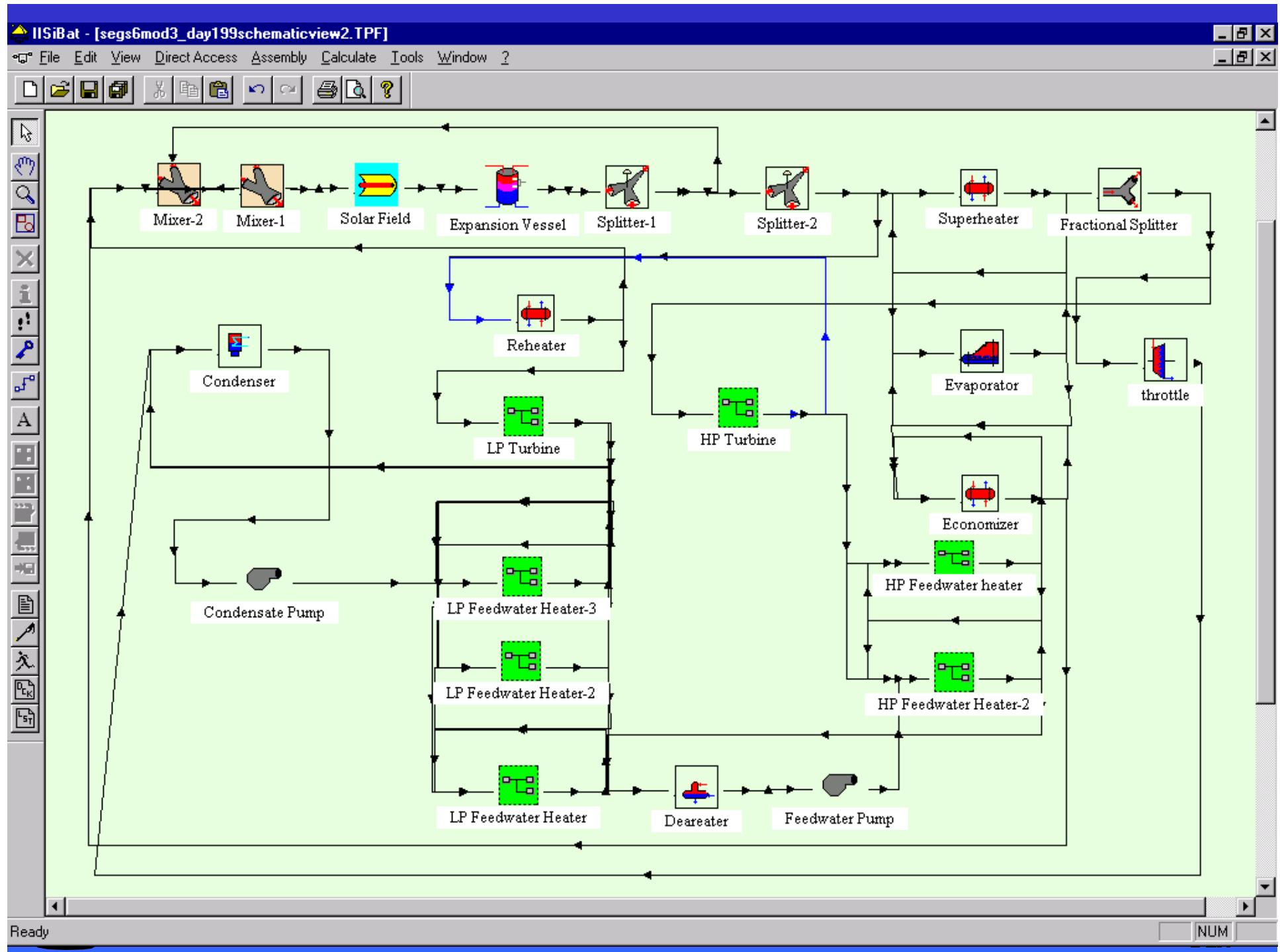
- Solar Thermal Electric Component model library
- Developed by DLR and Sandia
- Being adopted by SolarPACES: Russians, CIEMAT, ANU involved
- State property models (ODE's)
 - Not just "energy"
 - Temperature, Pressure, Enthalpy



SEGS VI 30 MW Model

- Solar-only, no fossil burning modeled
- Detailed, quasi-steady state, property model of solar side and steam cycle
- Detailed model capable of simulating steady state operation and transients like startup, shutdown
 - Steam cycle startup recirculation modeled
 - Needed for accurate modeling of storage systems (e.g thermocline)

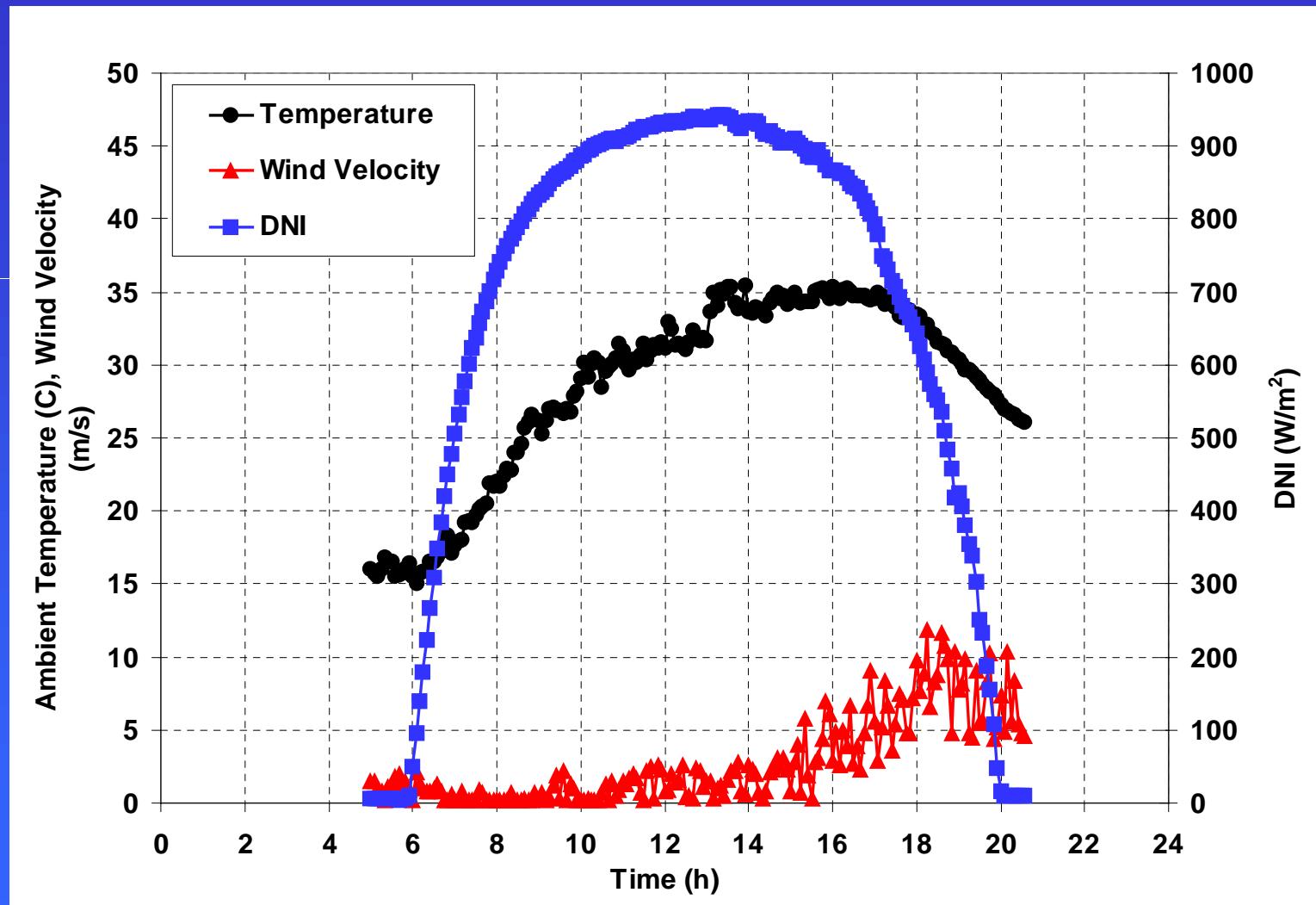




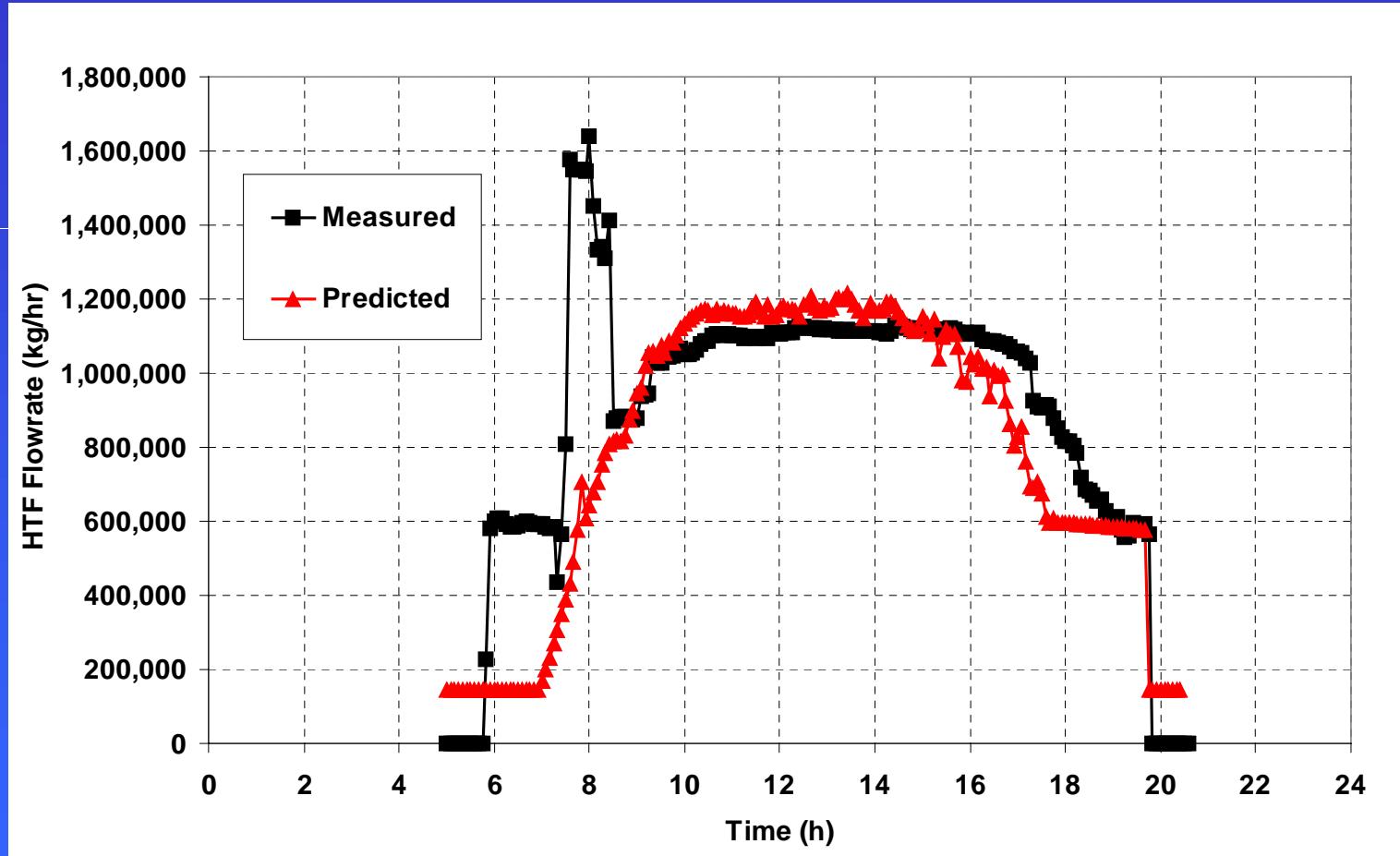
Validation

- Comparison with measured plant data
- Emphasis was on short time scales
- Daily comparisons, not annual

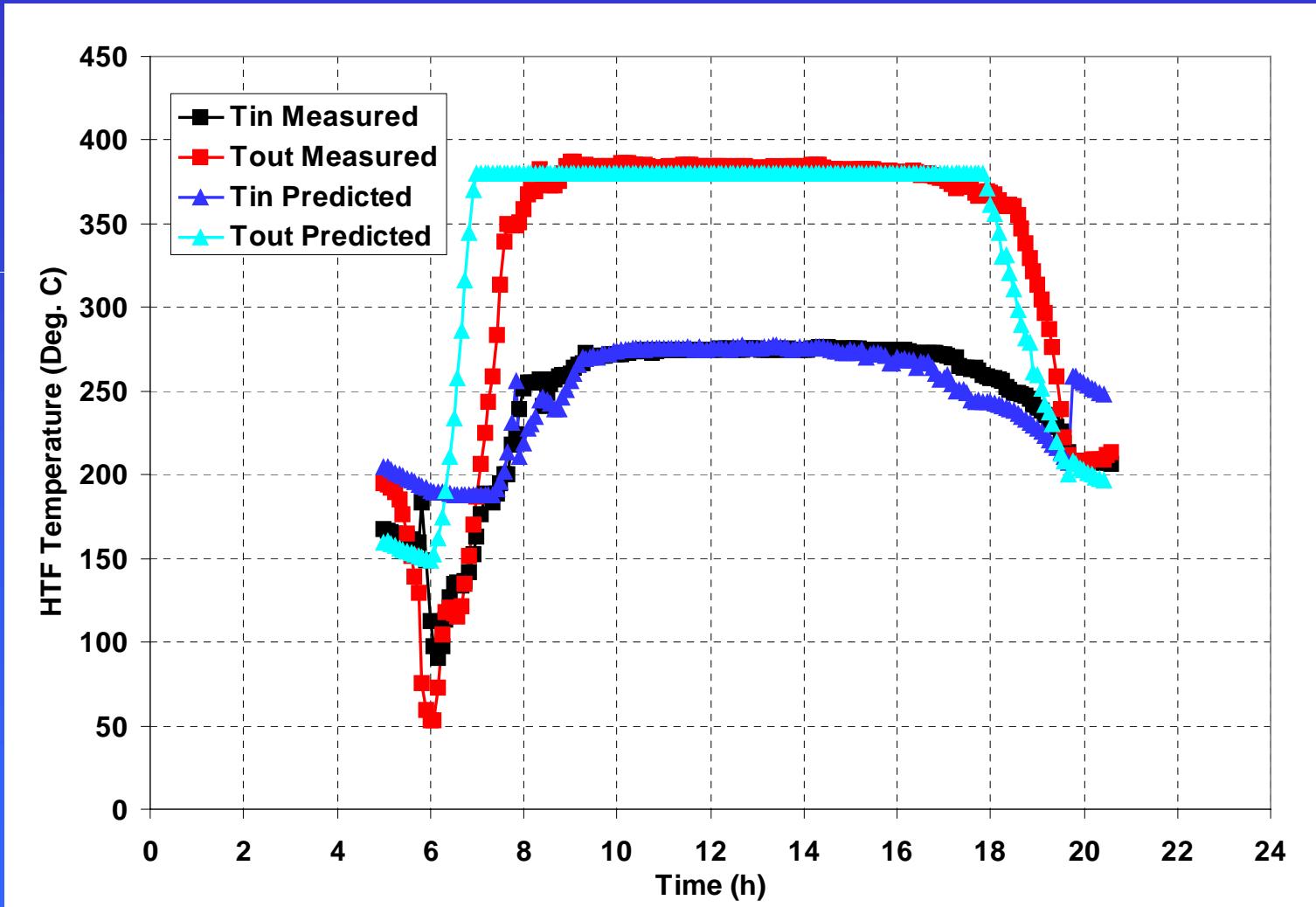
July 18, 1991 Weather



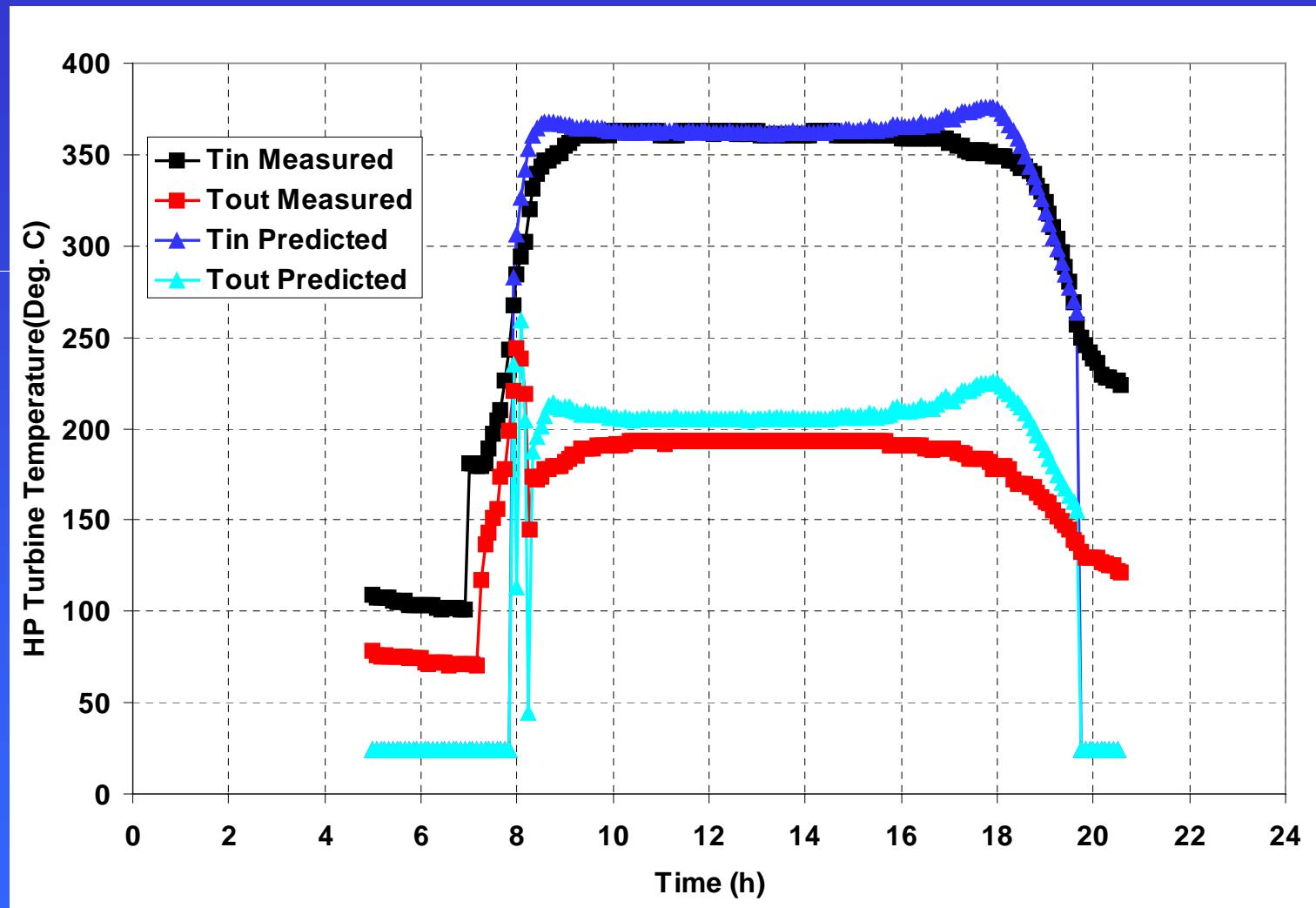
HTF Flow Rate – July 18



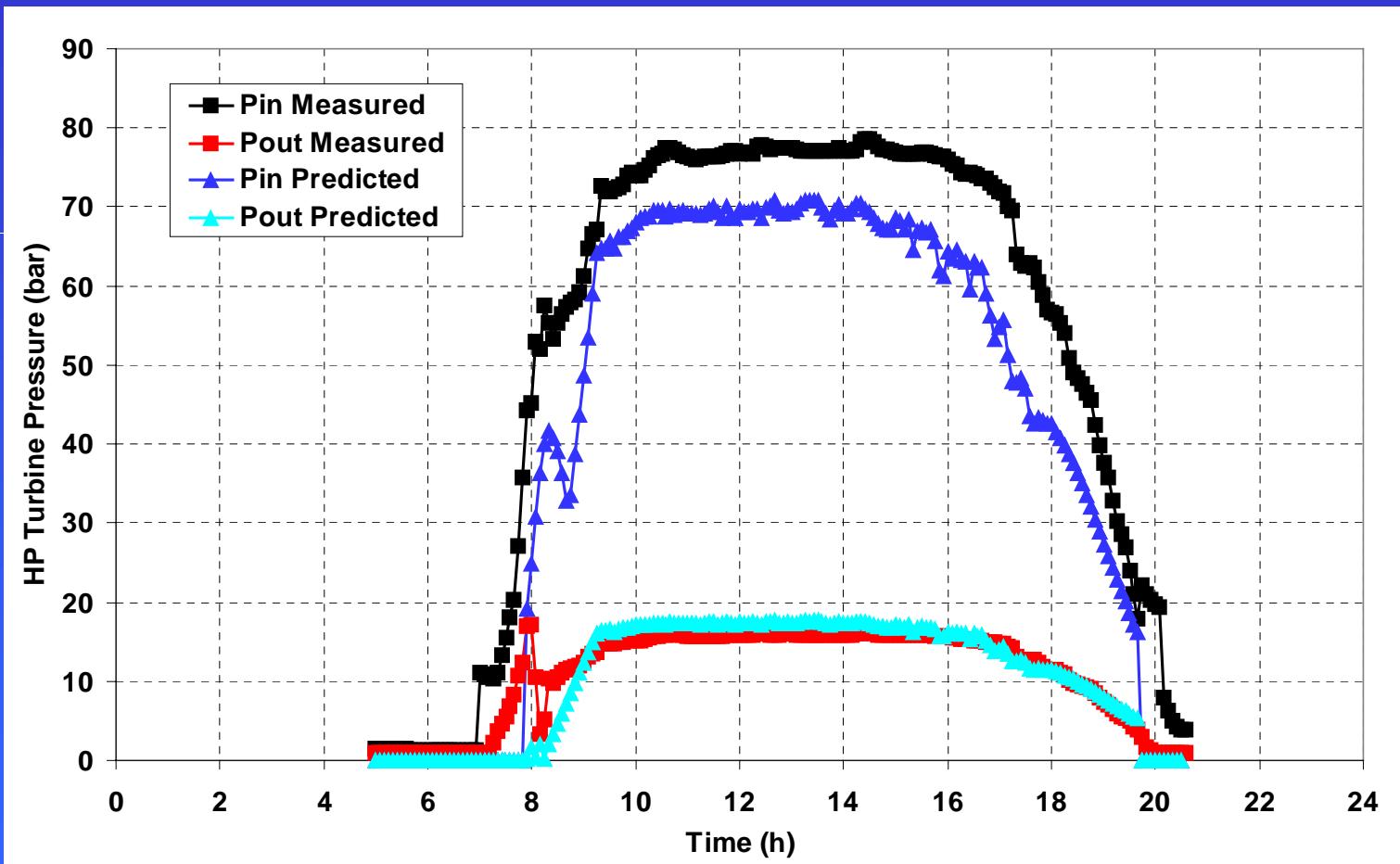
HTF Temperatures



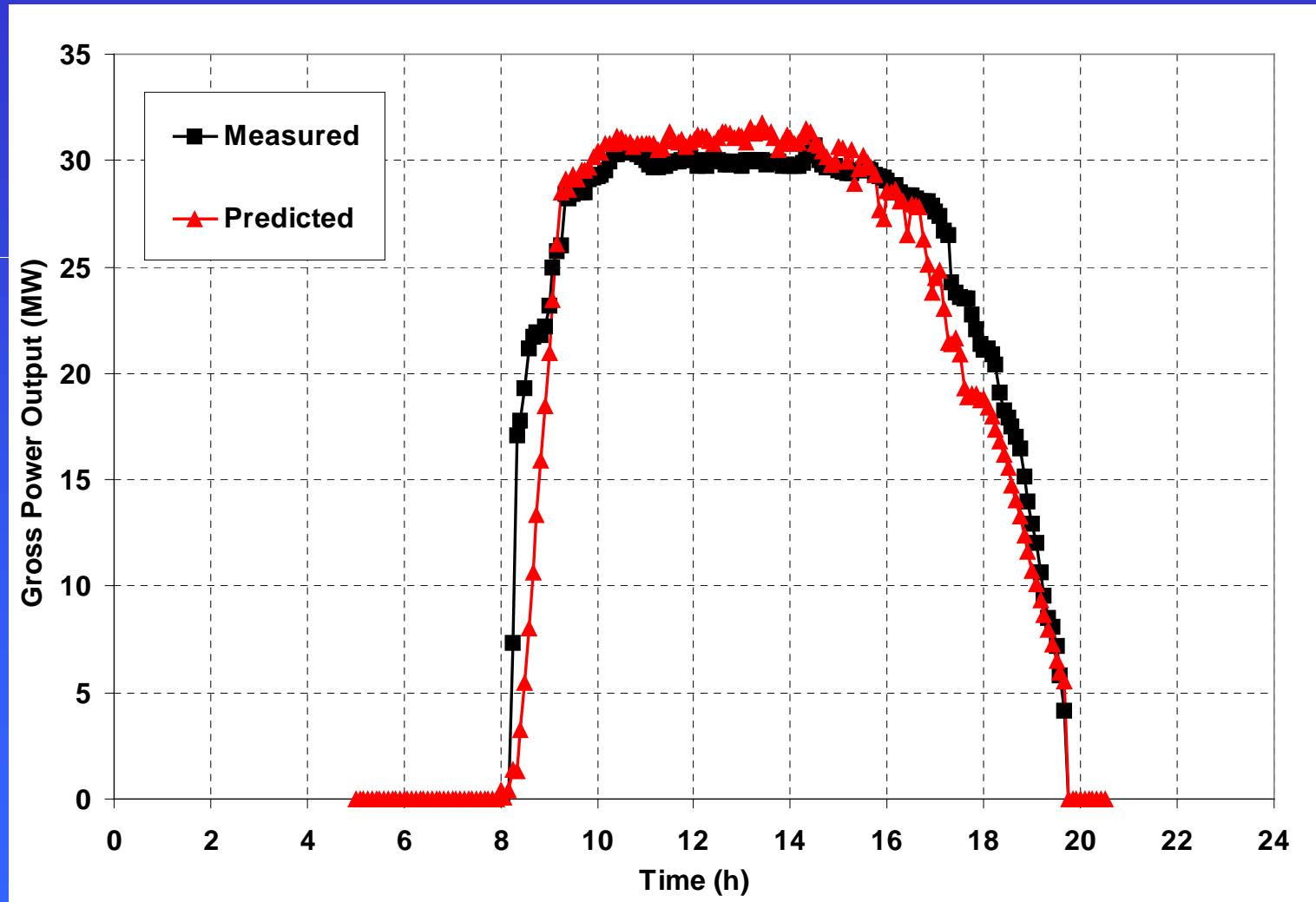
HP Turbine Steam Temperatures



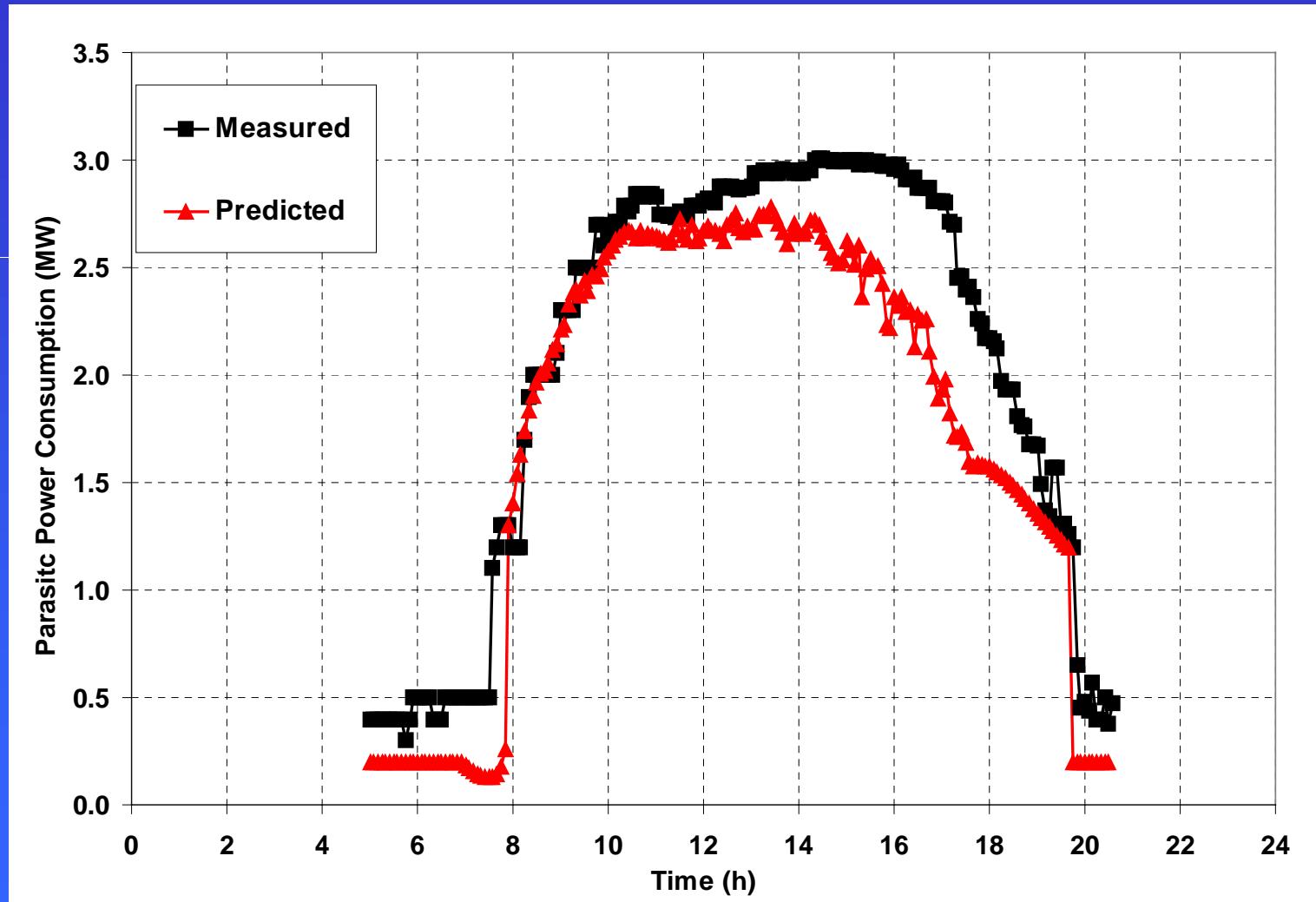
HP Turbine Steam Pressures



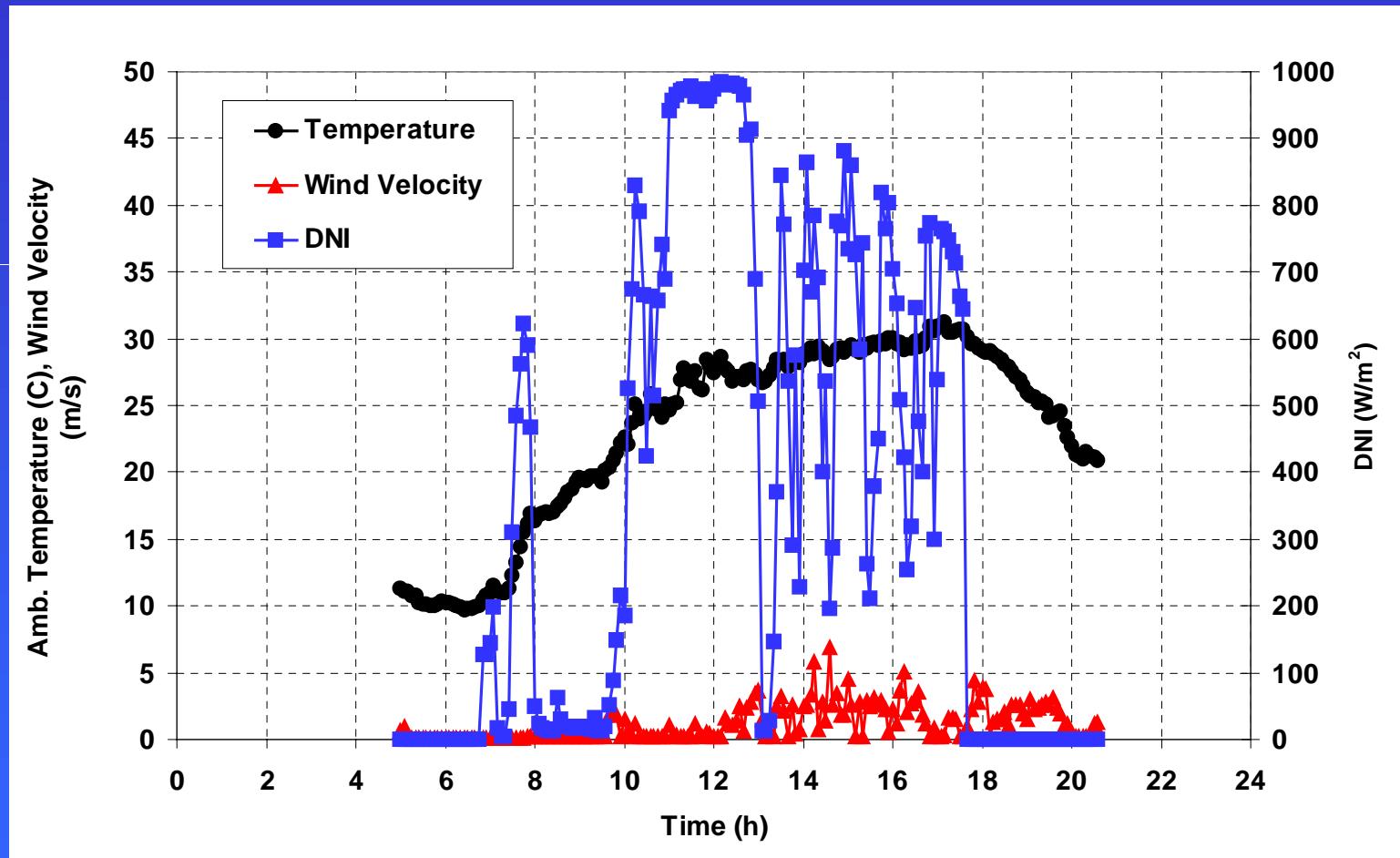
Gross Power Output



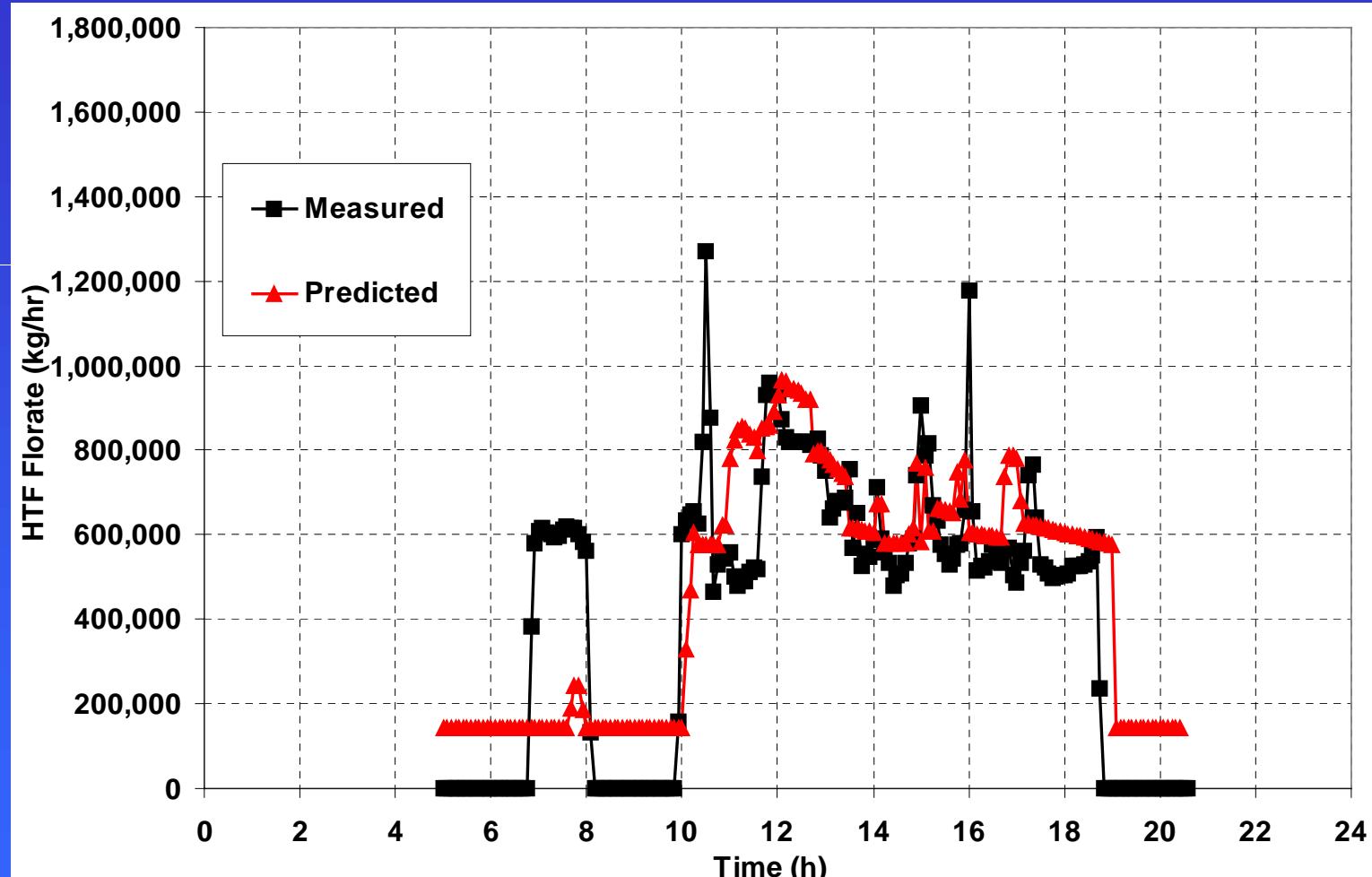
Parasitic Power Consumption



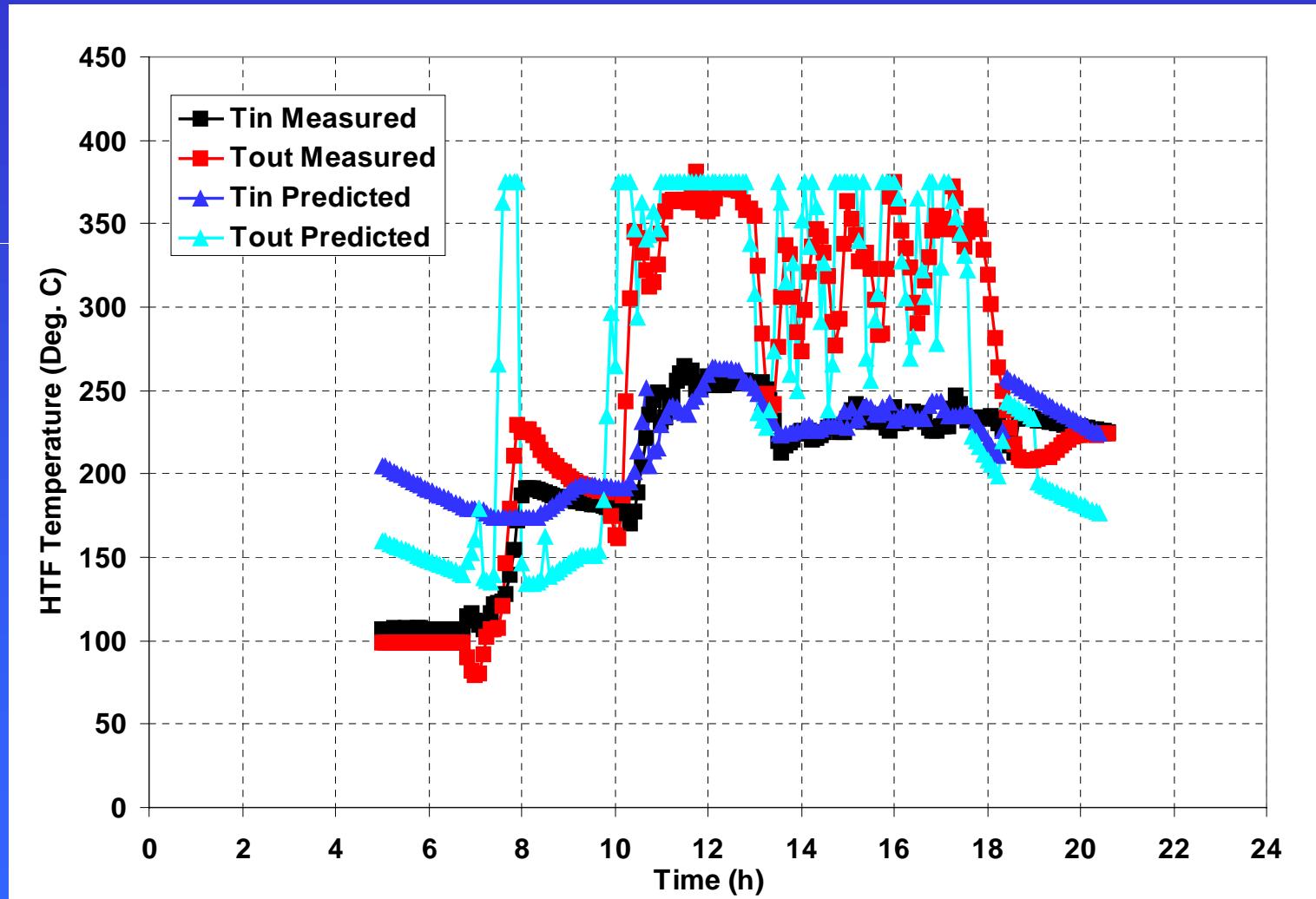
September 19, 1991 Weather



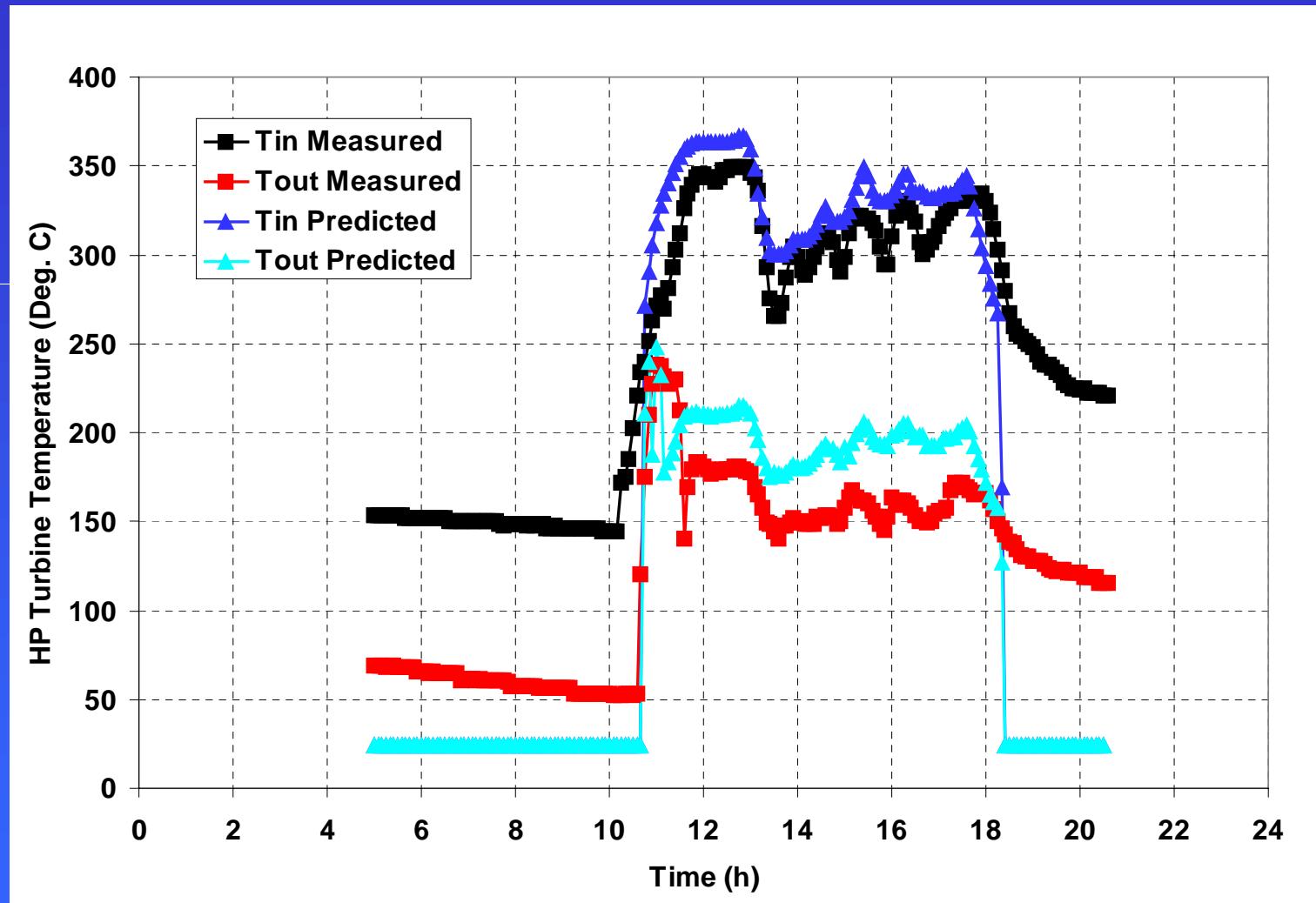
HTF Flow Rate



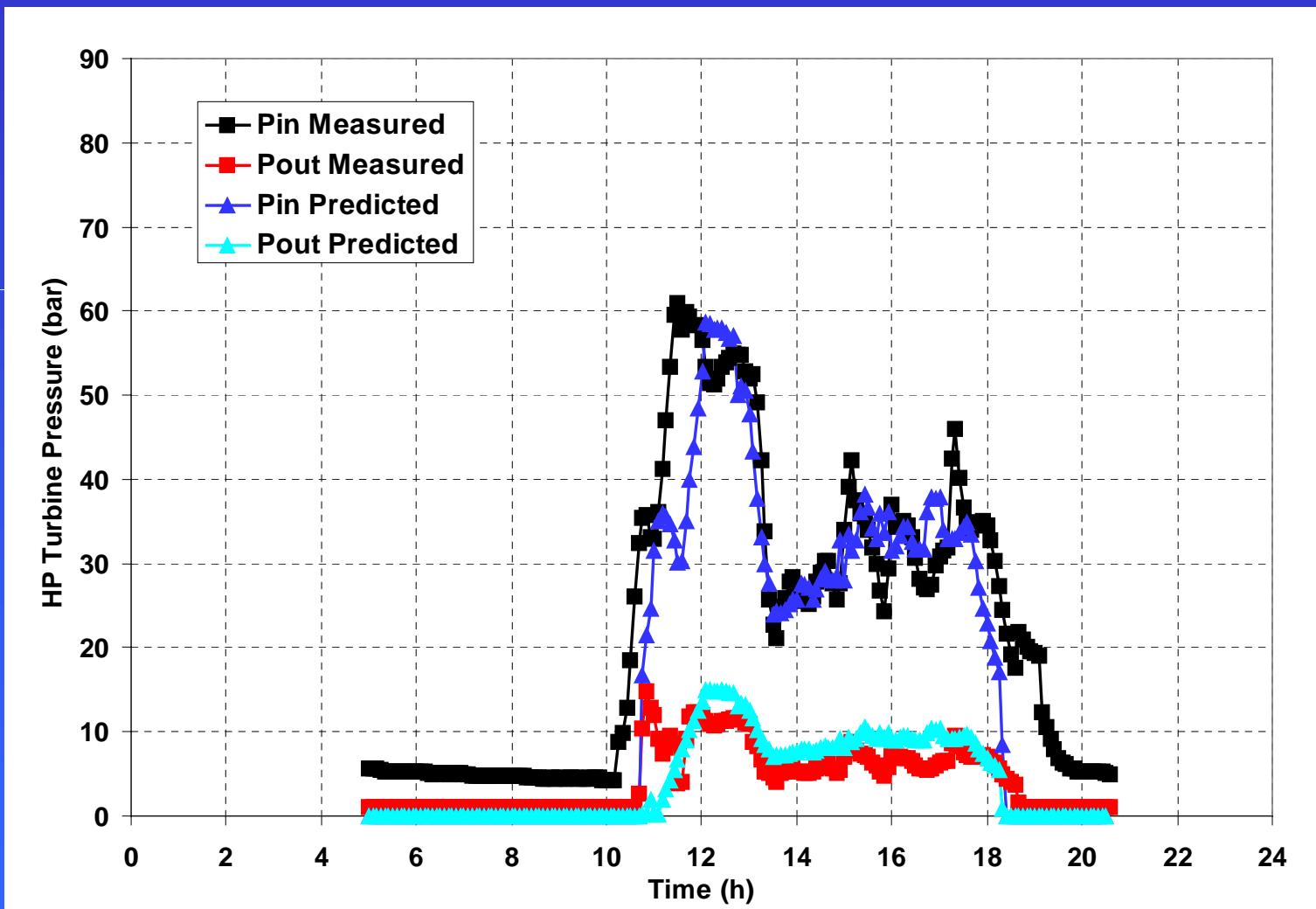
HTF Temperatures



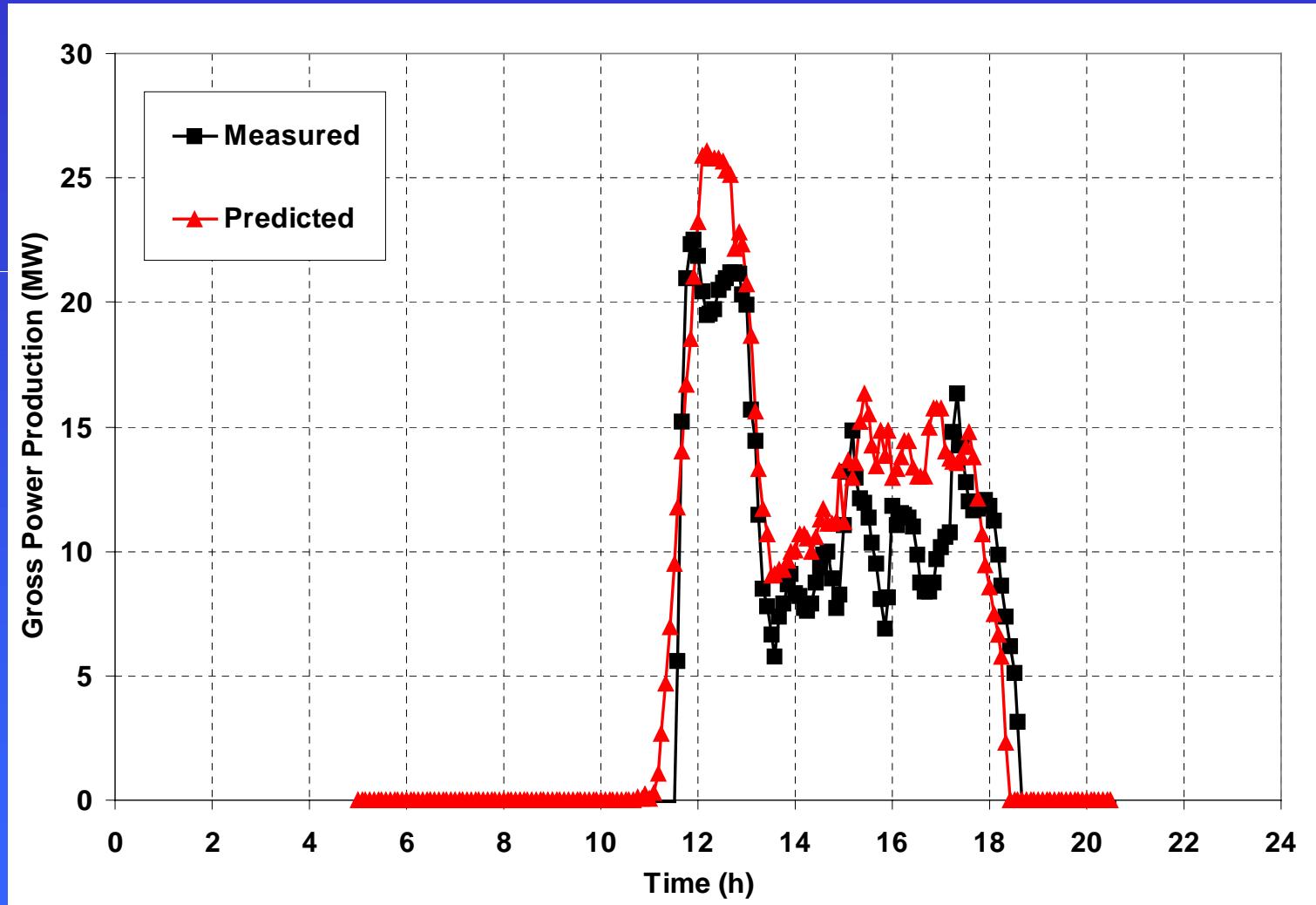
HP Turbine Steam Temperatures



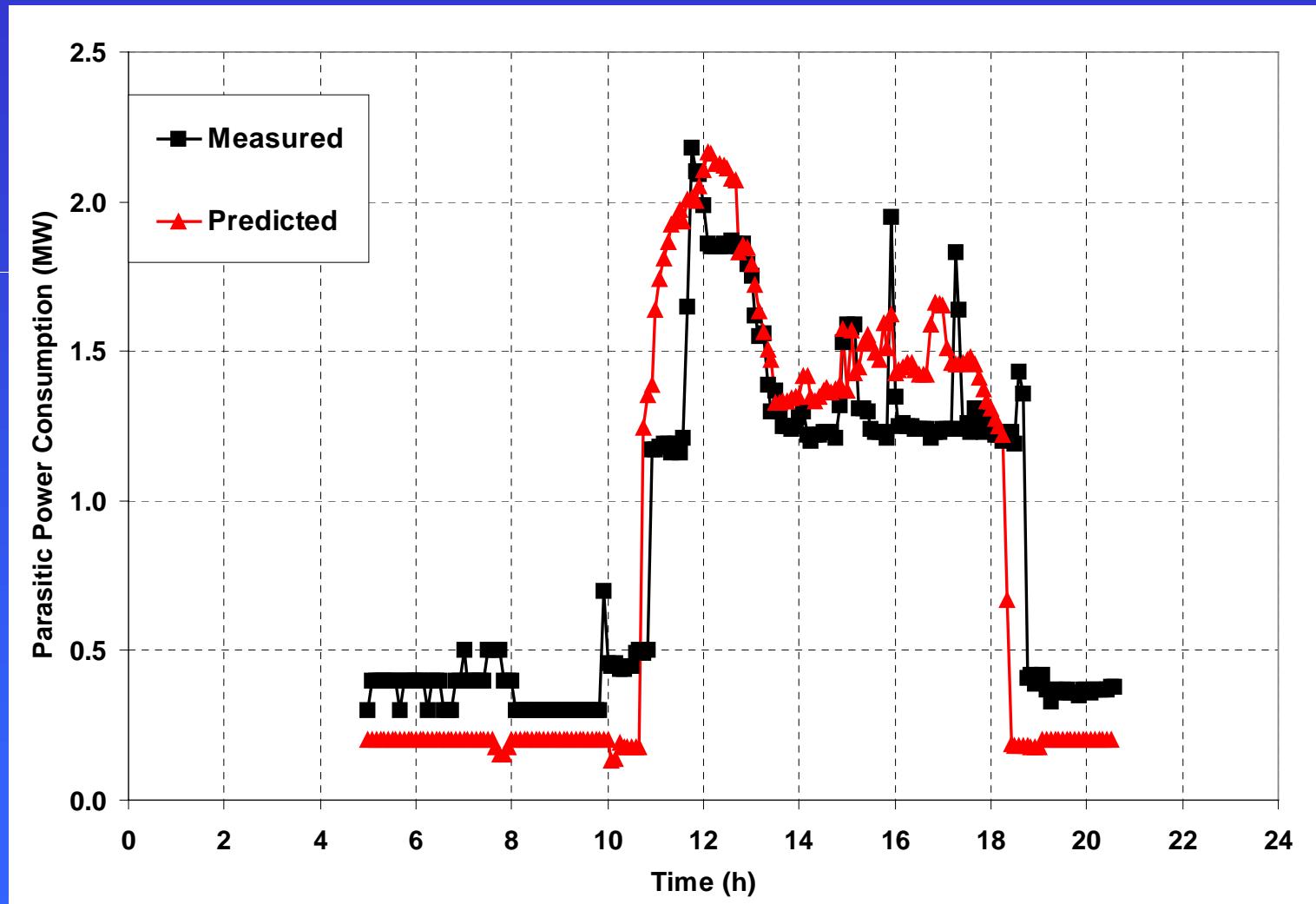
HP Turbine Steam Pressures



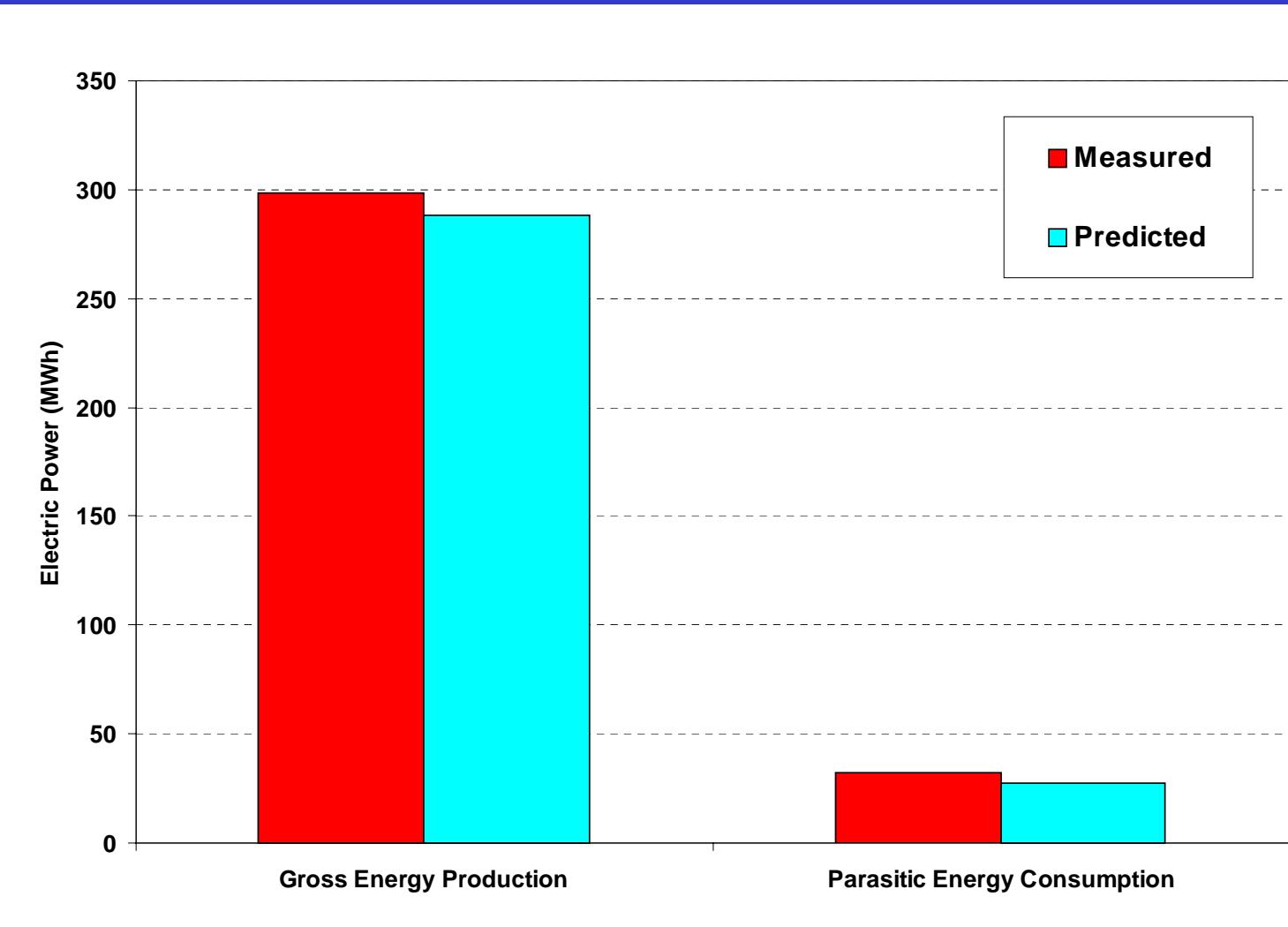
Gross Power Output



Parasitic Power Consumption



Gross Energy Production



Improved Trough Model

- New model still under development
- HTF residence time in trough loop (10 min – 60 minutes)
- Field piping residence time
- Currently model field thermal capacitance in the expansion vessel
- SEGSVIII (and new plants?) have exp. vessel downstream of SGS
- Accuracy required for storage modeling



Remaining Work

- Fine tune system parameters
- Advanced trough model
- Controls issues